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# EFFECT OF THINNING SECOND-GROWTH PONDEROSA PINE STANDS ON INCIDENCE OF MOUNTAIN PINE BEETLE INFESTATION

PROGRESS REPORT

by

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## INTRODUCTION

An epidemic infestation of mountain pine beetle, *Dendroctonus ponderosae* Hopk., was discovered during August 1969 on the Ninemile Ranger District and adjoining State and private lands on the Lolo National Forest. The infestation occurs in a 60- to 80-year-old mixed ponderosa pine, Douglas-fir stand that extends over approximately 30,000 acres. However, only about 2,600 acres are heavily infested. Much of the stand within this area is overstocked and stagnated. Ponderosa pine stands in overstocked condition generally are more susceptible to attack by mountain pine beetle (Sartwell 1971).

Surveys of these stands in 1970 estimated that 8.9 pines were killed per acre during the 2-year period 1969-70. This was 11 percent of the pine component or 8 percent of all stems. Volume loss attributed to the beetle was estimated at about 11 percent of the pine volume and 9 percent of the total stand volume (Ciesla et al. 1970).

Based on a study of second-growth ponderosa pine stands in eastern Oregon (Sartwell 1971), it was established that severity of tree killing was related to stand density on all sites, and that thinning of dense stands could be used as a silvicultural approach to prevent outbreaks of mountain pine beetle.

Based on Sartwell's findings, a study was established in 1971 to determine what effect thinning second-growth ponderosa pine stands would have on incidence of mountain pine beetle attacks in the Ninemile area. Since

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the Ninemile District had planned for a precommercial and a commercial thinning of two separate areas, this provided an ideal area for study.

## LOCATION AND DESCRIPTION OF STUDY AREAS

The original study was designed for two thinning areas and a check block for each. The four study areas selected were in a 60- to 80-year-old mixed second-growth ponderosa pine, Douglas-fir stand at 3,200 to 3,600 feet elevation. The precommercial thinning block consisted of 630 acres and was located in Isaacs Creek, T. 15 N., R. 22 W., sec. 9-10. The commercial thinning block was located in the Stoney Creek drainage in T. 15 N., R. 22 W., sec. 31-32.

The check blocks were 200 acres each and were located in the Stoney Creek drainage, sections 6, 9, and 10 in T. 15 N., R. 22 W.

Habitat type of the blocks in Isaacs Creek were *Pseudotsuga menziesii-Symphoricarpos* on a class VII site. The Stoney Creek block was also a site VII with a *Pseudotsuga-Physocarpus* habitat type.

Thinning of the precommercial block was completed in early spring 1971. The commercial thinning block has not been thinned to date.

## SURVEY METHODS

Prethinning and postthinning variable plot strip surveys were conducted to determine tree and volume losses caused by the mountain pine beetle during the falls of 1971 and 1972. Cruise lines were established at 5-chain intervals throughout the blocks. The first variable plot (BA = 20) was taken at the start of a line, 2½ chains in from the corner of the block to be surveyed. Then plots were taken at 5-chain intervals on cruise lines. At each plot center, wedge prisms were used to determine trees (5 inches d.b.h. and larger) to be tallied. Each tree tallied was recorded as to species, measured to the nearest inch at breast height (d.b.h.), and total height was measured with a clinometer. Ponderosa pines at each plot were classed into one of the following categories:

0 - green trees; uninfested.

1 - 1972 attack; faded with only a few green needles throughout the crown, brood present.

2 - 1971 attack; faded needles, no brood.

3 - 1970 or earlier attack; dropped majority of needles.

4 - pitchout; green tree, pitch tubes, no brood.

Similar surveys are anticipated for 1973, 1974, and 1975 to determine continuing effects.

Results of the prethinning survey were reported earlier (McGregor 1972).

Specific data obtained from this survey were:

1. Number of trees per acre by species in the thinned and unthinned stands.

2. Volume loss in board feet of pine killed by *D. ponderosae* in thinned and unthinned stands.

3. Estimates of residual stocking, volume, and basal area following 5 years of infestation in the thinned and unthinned stands.

## RESULTS

Results of survey on thinning and check blocks are shown in tables 1 and 2.

Table 1.--Number of trees killed per acre by the mountain pine beetle

| Area | 1970 or prior | 1971 | 1972 | Total trees killed | Remaining green trees/acre | | |
|---|---|---|---|---|---|---|---|
| | | | | | Ponderosa pine | Douglas-fir | Western larch |
| Stoney Cr. check block | 22.1 | 0.2 | 2.9 | 25.2 | 76.7 | 69.5 | 2.2 |
| Average d.b.h. | 8.0 | 14.0 | 8.0 | | | | |
| % ponderosa pine killed | 21.1 | 0.2 | 2.8 | | | | |
| Isaacs Cr. thinning block | 1.3 | 3.0 | 0.2 | 4.5 | 73.3 | 93.5 | 4.2 |
| Average d.b.h. | 8.0 | 11.0 | 10.0 | | | | |
| % ponderosa pine killed | 1.6 | 3.9 | 0.2 | | | | |
| Isaacs Cr. check block | 58.7 | 11.6 | 13.8 | 84.1 | 27.7 | 83.0 | 5.1 |
| Average d.b.h. | 9.0 | 8.0 | 8.0 | | | | |
| % ponderosa pine killed | 39.5 | 12.9 | 17.6 | | | | |

Table 2.--Volume of ponderosa pine killed per acre (bd. ft.) by the mountain pine beetle

| Area | 1970 or prior | 1971 | 1972 | Total volume loss |
|---|---|---|---|---|
| Stoney Cr. check block | 278 | 25 | 31 | 334 |
| Isaacs Cr. thinning block | 18 | 23 | 5 | 46 |
| Isaacs Cr. check block | 995 | 150 | 233 | 1,378 |

Approximately 371,845 board feet of pine were killed during the 3-year period 1970-72 in areas surveyed. This is an average of 172 board feet per acre. Of the ponderosa pine killed, 63 percent were killed in 1970, 19 percent in 1971, and 18 percent in 1972. The number of ponderosa pine killed per acre ranged from as low as 0.2 tree per acre in the Stoney Creek check block in 1971 to as many as 59 in the Isaacs Creek block in 1971. The number of trees killed per acre averaged 12 over the 3-year period. Diameter of infested trees ranged from 7 to 14 inches, average 9 inches.

In the 12-month interval since precommercial thinning of the Isaacs Creek block, 0.2 of a tree per acre was killed compared to three trees per acre in 1971 prior to thinning and 1.3 in 1970. Original stocking was 298 trees per acre prior to thinning. This was reduced to 294 trees per acre by the mountain pine beetle prior to thinning. Since thinning, there are 167 trees per acre.

The basal area ranged from 214 to 364 square feet in the blocks surveyed prior to beetle activity and thinning. Over half of the square foot basal area is contained in trees 5 inches d.b.h. or less in size.

## DISCUSSION

Outbreaks of mountain pine beetle in ponderosa pine usually do not build up rapidly; rather they build up over several years (Sartwell 1971). However, this outbreak was well established and was estimated to occur at epidemic level at about 30,000 acres the first year it was detected (Ciesla et al. 1970).

Evidence to date strongly indicates that thinning second-growth ponderosa pine stands in western Montana will reduce the number of trees attacked by the mountain pine beetle. Within the area thinned only 0.2 of an infested tree per acre occurred in 1972, opposed to 3.0 infested trees per acre in the block prior to thinning, and 14 per acre infested trees in the adjacent check block. Indication is that thinning changes the micro-environment of the stand, or affects individual tree characteristics, making trees unattractive to the mountain pine beetle. Sartwell (1971) believes that beetle-caused mortality occurs because overcrowding reduces vigor of ponderosa pines and allows the beetle to overcome a larger proportion of the trees in dense stands than in sparse ones.

In addition to killing many desirable crop trees and creating many understocked holes in the stand, the beetle appears to be converting the stands from ponderosa pine to Douglas-fir. This could be detrimental, particularly with the present western spruce budworm infestation in the Ninemile area.

Evidence indicates that thinning of beetle-infested second-growth ponderosa pine stands, preferably prior to infestation, will (1) release trees in the stand and thereby increase ultimate yield, (2) reduce

susceptibility of individual trees to bark beetle attack, and (3) decrease number of attacked trees, resulting in a more uniform stand distribution and utilization of the basic soil resource.

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